figures in the former and two in the latter would be ample. Indeed, those familiar with insulation resistance measurement will agree that to get results concordant even in the exponent of 10, let alone the significant figures, is not always easy with such material as paraffin wax, and a much greater accuracy in stating the measurement has, therefore, no meaning.

The illustrations, of which there are nearly 300, are on the whole good, especially those of apparatus. Among the illustrations, however, there are some diagrams, such as Fig. 88, which are singularly poor, chiefly through faulty perspective drawing.

The section on glow-lamps is good and up to date, and includes a very full account of the construction and use of vacuum pumps. The subject of arc-lamps and of illumination is also well treated. The concluding section, on the "production of electromotive force" (induced voltage being, presumably, excluded), contains an account of thermoelectric effects and of primary and secondary cells, the latter being given due prominence, as becomes their importance to the engineer.

The descriptive portion of the work is throughout very carefully written and illustrated. It is full of representative information as to recent types of apparatus. It will thus be seen that Mr. Parr has placed before us a book on the elements of electrical engineering which, if not satisfying from every point of view, is nevertheless a good example of the type of text-book which will introduce the student at once to the theory and to the elementary practice of his subject. D. K. M.

COLLECTED WORKS OF ERNST ABBE. *Gesammelte Abhandlungen.* Zweiter Band. By E. Abbe. Pp. ii+346. (Jena: G. Fischer, 1906.) Price 7.50 marks.

THE first volume of Prof. Abbe's works has already been noticed in the pages of NATURE (vol. lxix., p. 497). The contents of the second volume, while extremely interesting, are more miscellaneous in their character. The editors did well in collecting together in one volume their author's epoch-making papers on the theory of the microscope and his original papers on optical problems.

Abbe's friends, however, will value the possession of his complete writings, and the volume now under review shows the width of his interests and the extent of his knowledge. It opens with his inaugural dissertation at Göttingen in 1861 on the experimental foundation of the law of the equivalence of heat and mechanical energy, a paper which deals chiefly with the thermodynamics of a perfect gas so far as they can be deduced from the first law. This is followed by two astronomical papers of somewhat local interest communicated to the Frankfort Physical Association.

The fourth paper is Abbe's dissertation on receiving authority to teach in the philosophical faculty at Jena in 1863, and is on the law of the distribution of errors in a series of observations.

Abbe's interest in optics was, as is well known, first aroused by the request to help Carl Zeiss in his construction of the microscope, and it is clear that as a young man other branches of science attracted him.

A paper reprinted from the Jena *Zeitschrift für Naturwissenschaft* for 1874 follows, occupying some eighty pages of the volume, and gives his own account of two of his best-known instruments. It is entitled "New Apparatus for the Determination of Refractive Indices and Dispersion Constants," and in it are described the Abbe refractometer and the method of determining refractive indices by total reflection.

The Abbe refractometer is well known, and in the skilful hands of the Jena firm has developed into a most useful and valuable instrument. Abbe's own account of its development and of the reasons which led him to its adoption are full of interest; it was one of his earliest instruments in which the principle of autocollimation was employed; the light from the collimator is made to fall normally on the second face of the prism the index of which is required and to retrace its path; when this is the case the angle of refraction is equal to the angle of the prism, and can be easily measured; the angle of incidence can also be measured, and from a knowledge of the two the refractive index is obtained. The principle which forms the basis of the method described in the second part of the paper has been further developed by Pulfrich in his well-known total refractometer.

Another interesting article is the first list of the productions of the glass technical laboratory of Schott and Company at Jena, dated July, 1886. The story of this work has often been told; the growth of the Jena firm in the twenty years which have elapsed since the first list was published affords conclusive proof of the fertility of the union of the mathematician who had the skill to apply his knowledge in aid of the needs of industry and the manufacturer who realised that Abbe's science had a commercial value, and could be made a factor of real importance in the struggle for progress.

The introduction to this first catalogue of optical glasses opens thus:—

"The industrial undertaking which is here first brought before the notice of the public arose out of a scientific investigation into the dependence of the optical properties of solid amorphous fluxes on their chemical composition which was undertaken by the undersigned with a view to bring to light the chemico-physical foundations of the production of optical glass"—

and though at present there are many problems which confront the glass maker, thanks to the researches of Abbe and Schott the knowledge of 1906 is far in advance of that of 1886.

Enough has perhaps been written to show the interesting character of the book. Among the other papers are accounts of some of the various apparatus designed by Abbe, including the now well-known prism binocular, and some reviews and notices, both of books and men. Of these, perhaps the most noticeable is an address delivered in the hall of the Physical Institute at Jena on March 5, 1887, to commemorate the centenary of the birth of Fraunhofer,

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in which in eloquent words Abbe traces the debt of opticians to that great man.

At some future day a pupil of Abbe's will carry on the story and show how the next great advance in practical optics was the work of Abbe himself. His friends have done well to collect with loving care these writings of their master, and we who know him chiefly through his works are grateful to them for the manner in which they have discharged their task.

OUR BOOK SHELF.

Magnetische Kraftfelder. By H. Ebert. Second edition. Pp. xii+415. (Leipzig: J. A. Barth, 1905.) Price 7 marks.

THIS is a second edition of Prof. Ebert's well known treatise on magnetic fields of force, which first appeared in 1902. The author handles his subject as before with a wealth of illustration, and with a theoretical grasp, which make the book valuable alike to student and teacher. Indeed, the teacher will find in its pages many useful suggestions. Of these is the magnetic vane of Jaumann, depicted on p. 23, which recalls the appliance of Petruscheffsky, in which a small bar magnet was suspended through one pole, with a counterpoise to make it lie horizontally, and act as a one-pole magnet. Again, the little frame depicted on p. 29 for holding bar magnets during the operation of manufacturing their filing figures on a sheet of glass above them is worthy of notice. The author adopts as a brief synonym for "a point in a magnetic field to which we direct our attention" Boltzmann's term "Aufpunkt," for which we have no English equivalent. On p. 206 he uses the term "Billiontel" for 10^{-9}, which is surely a slip, since in German, as in English, a billion is 10^{12}, not 10^{9}. On p. 54 his definition of unit pole is that it is such as to repel with a force of 1 dyne a similar pole when at a distance of 1 centimetre apart *in vacuo*, whereas hitherto the accepted definition has been when *in air*. The difference may be unimportant, but it should not pass without challenge. In this edition the author has cut out most of the section upon cyclical systems, and certain deductions of the Maxwell-Hertz equations which were formerly included. On the other hand, he has introduced new matter relating to the electronic view of electricity in its relation to magnetism and to the Zeeman phenomenon. While this part of the book has been shortened, there have been added at the end fresh sections on induction, on the magnetic circuit—a distinctly valuable chapter—and another of lesser merit on dynamo-machines. The author erroneously attributes to Pixii, on p. 359, the invention of the split-tube commutator. What Pixii used in 1832, on the suggestion of Ampère, was the divided mercury-cup familiar to electricians in the primitive motors of Ritchie.

It is distinctly interesting to find a summary of recent work on kathode rays, Becquerel rays, and the rays emitted by radium, appearing as an integral part of a chapter which opens with the action of the magnetic field upon a movable conductor carrying a current. The doctrine of the electron appears to be thoroughly accepted as an essential part of electromagnetism. But the definitions which the author gives on pp. 157 and 158 of an electron apparently exclude anything and everything that is not actually moving with a high velocity:—"Unter Elektron hat man die sich mit grosser Geschwindigkeit bewegende negative Elementarladung zu verstehen." Is an electron not an electron when it is at rest?

S. P. T.

Inheritance in Poultry. By C. B. Davenport. Pp. v+134. (Washington, D.C.: The Carnegie Institution, 1906.)

THIS is a valuable addition to the rapidly-increasing literature dealing with the subject of inheritance. It affords a good example of the growing complexity of the theories which have been founded on the famous discovery of Mendel. The simplicity of the original Mendelian system has now to be supplemented by such conceptions as those of "imperfect dominance," "incomplete segregation," "compound allelomorphs," and the like. The author of the present treatise, well known as the director of the station for experimental evolution at Cold Spring Harbour, New York, deserves much credit for the care with which his experiments have been devised and their results recorded. Each experiment is methodically described under the heads of "Statement of Problem," "Material," "Results," "Conclusions," and the general bearing of the whole series on evolutionary theory receives full and candid discussion in a final section. The author's standpoint, as was to be expected, is in the main Mendelian, but he recognises the facts that both dominance and recessiveness are frequently incomplete, and that "an adequate theory of gametic purity has not only to explain the simple Mendelian formula, but also the facts of imperfect dominance, impurity of extracted forms, latency and atavism, and occasional particulate inheritance." Prepotency (in Bateson's sense) he holds to be as truly important in inheritance as dominance. It is worth noting that de Vries's dictum as to the sharp separation of the constituent units which make up the characteristics of organisms, between which units transitions exist "as little as between the molecules of chemistry," is, in the author's opinion, not borne out by the present experiments; nor does he find confirmation of the same biologist's assertion as to the different modes of inheritance of "specific" and "varietal" characteristics.

There are a few marks of carelessness in the text, as where the birds represented by Figs. 1 and 2 are spoken of as "black-crested white Polish." The plates are generally admirable, but in the absence of colour it is difficult to distinguish between true white and reflected high lights—a point which in some cases is of great importance.

F. A. D.

German Scientific and Technological Reader. Book i., pp. ix+105; Book ii., pp. viii+115. By E. Classen and J. Lustgarten. (London and New York: Harper and Brothers, 1906.) Price 2*s.* net each.

THESE two books should serve a useful purpose in familiarising students of science who are anxious to read scientific works in the German language with expressions and terms common in such works, but not to be found in school-books. Both volumes consist of descriptive accounts of principles and properties relating to various departments of science, and of technological processes, plainly printed in Roman characters, and suitable for reading by students who know the rudiments of German grammar.

The descriptions in the first volume deal with the propædeutics of physical and chemical science, dyeing, metallurgy, electrotechnics, and engineering; and those in the second volume are concerned, in addition, with some special points in physics, chemistry and chemical technology, spinning and weaving, and brewing. There is a vocabulary in the first volume, but not in the second, which is somewhat more advanced, and requires the use of a dictionary.

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